

n_factor_and_sex_ratio_of_Grey _Reef_Shark_in_Makassar_Strai 1.pdf *by*

Submission date: 30-Dec-2021 09:20PM (UTC+0700)

Submission ID: 1736473661

File name: n_factor_and_sex_ratio_of_Grey_Reef_Shark_in_Makassar_Strai1.pdf (339.46K)

Word count: 2790

Character count: 13922

PAPER · OPEN ACCESS

Growth pattern, condition factor and sex ratio of Grey Reef Shark *Carcharhinus amblyrhynchos* (Bleeker, 1856) in Makassar Strait

5
To cite this article: N L Rapi *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* 564 012016

View the [article online](#) for updates and enhancements.



The banner features a dark blue background with a globe. On the left, there are three circular logos: EGS (Electrochemical Society), ECS (Electrochemical Society of Korea), and The Korean Electrochemical Society. The central text reads "Joint International Meeting PRIME 2020 October 4-9, 2020" in white and blue. Below this, a blue bar contains the text "Attendees register at NO COST!". On the right, the PRIME logo is displayed, with "PRIME" in large white letters, "PACIFIC RIM MEETING" in smaller white letters, and "ON ELECTROCHEMICAL AND SOLID STATE SCIENCE" in even smaller white letters. Below the PRIME logo, the year "2020" is written in white. At the bottom right, a blue button with white text says "REGISTER NOW" followed by a right-pointing arrow.

⁴
Growth pattern, condition factor and sex ratio of Grey Reef Shark *Carcharhinus amblyrhynchos* (Bleeker, 1856) in Makassar Strait

N L Rapi¹, A Mallawa¹, J Tresnati², and F Amir¹

¹ Fisheries Resources Utilization Study Program, Hasanuddin University

² Aquatic Resources Management Study Program, Hanuddin University

Email: fishreni@gmail.com

Abstract. Shark has been a sought-after species by fishermen due to its high economic value in the International market. It has increased shark's fishing pressure on its wild population. Local fishermen are more likely to catch a grey reef shark rather than other fish commodities. The present study aimed to describe the length and weight relationships (LWRs), growth pattern, and sex ratio of Grey Reef Shark shark *Carcharhinus amblyrhynchos* (Bleeker, 1856) caught in Makassar Strait. Sampling was conducted from September to November 2019. The results showed that the total length of sharks caught ranged between 18 cm - 235 cm and weight between 1 kg - 120 kg. The growth pattern of the graceful shark was negative allometric growth, and the relative condition factors for males and females were 0.3131 - 2.4813 and 0.2965 - 1.6244, respectively. The sex ratio between males and females was 1:1.33.

1. Introduction

Sharks belong to the elasmobranch group, which identifies as cartilaginous fish. This group of fish is known to have high diversity, a total of 75 species of sharks distributed from freshwater waters to sea waters in Indonesia. Fishing pressure on shark species has been increasing over the past two decades. At least 10 million sharks caught in Indonesia are taken from the wild, as reported by Indonesia's World Wide Fund for Nature (WWF) [1].

Shark has been a sought-after species by fishermen due to its high economic value. Several countries such as Hong Kong, China, Japan, Taiwan, and Singapore have been exported destinations for shark commodities. Shark export commodity is divided into several products, such as fins, meat, bones, skin, liver oil, and teeth [2]. Almost all parts of the shark's body are valuable. It encourages fishermen to further exploiting the wild shark leading to overfished due to unsustainable fishing practices.

In order to understand the current state of wild shark, especially Grey Reef Shark *Carcharhinus amblyrhynchos* (Bleeker, 1856) in Makassar Strait, a study on fish biology and sustainable biological resources management is required. The present study aimed to describe the length-weight relationships (LWRs), growth pattern, sex ratio, and feeding habit of Grey Reef Shark *Carcharhinus amblyrhynchos*



³ Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

Published under licence by IOP Publishing Ltd

(Bleeker, 1856) in Makassar Strait. Furthermore, this study supports the National Action Plan for Shark and Stingray Conservation Management or "Rencana Aksi Nasional" (RAN) in 2016-2020.

2. Research methodology

This study was conducted from September to November 2019 in Makassar Strait. A descriptive method with observation techniques (direct observation) was performed for direct collection. Sampling was carried out using long-line fishing gear and gill net for three times a week, a total of 345 specimens were used during the study period. The fish samples were collected, kept alive and intact for direct biometric measurements. Data were collected on the total length, weight, and sex of the Grey Reef Shark. The biometric measurements for total length were used length measuring tools with a degree of precision is 1 cm, and hanging weight scale with the degree of precision is 1 kg. The length and weight data were used in the length-weight relationships (LWRs) and growth pattern analysis. The data on the sex of shark was used for sex ratio.

3. Data analysis

3.1. Length-weight relationships (LWRs) and growth pattern

The log transformation formula was used to establish LWRs according to Hetty et.al., (2018) [3] as follows:

$$W = aL^b \text{ or } \log W = \log a + b \log L \quad (1)$$

Where: W = the body weight (g); L = the standard body length (cm); a = the intercept; and b = the slope

The isometric shark growth pattern when $b = 3$, i.e., balanced length and weight gain, and allometric growth pattern if $b \neq 3$, i.e., increase in length and weight is not balanced. If the value of $b > 3$, then the pattern of allometric growth is positive and negative if $b < 3$ is tested t ($p > 0.05$).

3.2. Relative condition factor (K_n)

The weight gain is not as fast as their length, or length-weight relationship is allometric, the condition factor was calculated using the Froese equation [4] as follows:

$$C_F = (Wb/aL^b) \text{ or } CF = Wb/W^*, \quad (2)$$

$$Wb = (W1+W2+W3+..Wn)/n, \text{ dan } W^* = aL^b, \quad (3)$$

Where: W = mean fish weight (gram) within length class, L = mean fish length (cm) within length class.

11. Sex ratio

Sex ratio was calculated using the equation below:

$$NK = \frac{\sum J}{\sum B} \quad (4)$$

Where: NK = sex ratio, $\sum J$ = number of male sharks (samples), $\sum B$ = number of female sharks (samples)

To find out the sex ratio between male and female fish at each sampling time is equal to 1.00: 1.00 or not, we use the chi-square test arranged in the form of a contingency table [5].

$$E_{ij} = \frac{n_{io} \times n_{oj}}{n} \quad (5)$$

Where: E_{ij} = expected theoretical frequency to occur, n_{io} = number of lines to i , n_{oj} = number of column to j , n = number of frequency from the value of observation.

$$\chi^2 = \sum_{i=1}^k \frac{O_i - E_i}{E_i} \quad (6)$$

Where: O_i = value which appears as observation result for male and female, E_i = value which expected to male and female fish

4. Results and discussion

4.1. Number of sharks caught during the study period

A total of 345 specimens was comprising of 148 males and 197 females. The total length of the Grey Reef Shark caught ranged from 18 cm to 235 cm, and the total weight of Grey Reef Shark ranged from 1 kg to 120 kg. The total length of the grey reef shark in Oeba Fish Landing (PPI) ranged from 30 cm to 73 cm [6]. In addition, the total length of the grey reef shark caught using the hand-line fishing technique ranged from 60 to 180 cm [7] and 55 cm - 261 cm [3]. The size of baby shark of 18 cm, according to White et al. (2006), male and female grey reef sharks in the length of 104–115 cm and baby shark size between 52 and 55 cm [8]. The type of fishing gear, fishing capacity, and fishing grounds. In general, traditional fishermen catch fish in areas with relatively shallow depths.

4.2. Length-weight relationships (LWRs)

The LWRs of sharks are used to describe fish growth patterns. This relationship can be estimated through the tendency of the distribution of length-weight data obtained based on the measurement of the total shark length. The LWRs analysis showed that the LWRs has the equation $\text{Log } W = 1,646 + 1,730 \log L$ or in the form of an exponential is $W = 1,646 L^{1.730}$ the value of determination (R^2) = 0.808 and the correlation value (r) = 0.899.

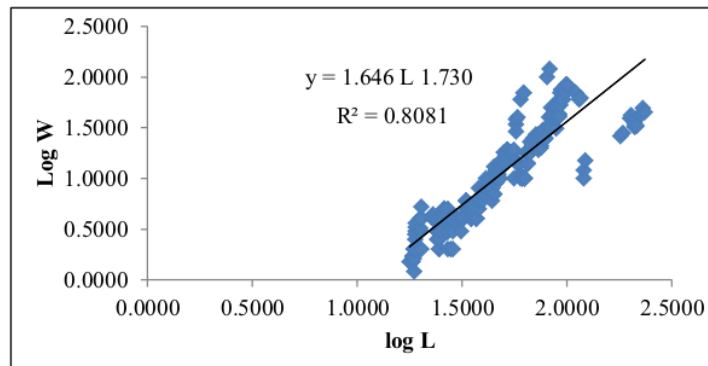


Figure 1. Length-weight grey reef Sharks *Carcharhinus amblyrhynchos* (Bleeker, 1856).

In general, the LWRs of sharks had a very close relationship (correlation coefficient value (r) close to one), meaning that the total length of the fish body could determine the bodyweight with the lowest level of confidence of 95%. After the T-test ($\alpha = 0.05$) in male and female fish and total Grey Reef Shark have a negative allometric growth pattern (Table 1) where the value of $b < 3$, which means that the weight growth is over-dominant compared to the increase of length.

Table 1. Length-weight relationships of grey reef Shark *Carcharhinus amblyrhynchos* (Bleeker, 1856).

Sex	Length-weight equations	R ²	r	Growth pattern
Male	1,639 L ^{1.724}	0,782	0,884	negative allometric
Female	1,652 L ^{1.740}	0,822	0,907	negative allometric
Total	1,646 L ^{1.730}	0,808	0,899	negative allometric

The assessment of LWRs (Table 1) showed that the value of the shark b is 1.65 (negative allometric). This indicates that the weight gain of fish is faster than the length of the fish. In terms of the agreement, for instance, Lowry et al. (2009) reported negative allometric growth patterns in the Grey Reef Shark [9]. Similarly, Noemie and Eric (2018) reported negative allometric growth patterns in the Grey Reef Shark. This finding indicated that the wild grey reef shark currently obtained considerable fishing pressure by the fishermen [10]. This condition was further considered to affect the length and weight of the fish [11]. In addition, fish growth is influenced by biological factors (gonad growth and sex), environment (adequate food and environmental factors), and conservation techniques as well as differences in observation time of the captured specimens [12].

4.3. Relative condition factor (K_n)

Relative condition factor of grey reef shark ranged from 0.3131 - 2.4813 (male) and 0.2965 - 1.6244 (female). The relative condition factor of female fish is smaller than male fish. It indicates that the condition of male fish is better than female fish over the whole year. The lowest value of the condition factor or < 1 obtained from the shark offspring (neonates) and juvenile, while the condition factor value > 1 is found in adult sharks. The relative condition factor of male sharks ranged from 0.206 to 2.225, and females ranged from 0.237 to 3.3361 [13]. The condition factor of Halmahera bamboo shark (*Hemiscyllium halmahera*) in Kao Bay, North Halmahera of 1.098, shows that the sharks are in good condition [14]. Fish with less flat or curved bodies have condition factor values ranging from 1-3. The difference in condition factor values is influenced by population density, gonad maturity level, food, sex, and age of fish [15].

4.4. Sex ratio

The Grey Reef Shark caught during the study periods consisted of 148 males and 197 females. Total distribution and sex ratio obtained during the sampling periods provided in table 1.

Table 2. Total distribution per Individual of Grey Reef Shark obtained during the data collection period.

Sampling Periods	Total distribution		Ratio	
	Male	Female	Male	Female
September	33	48	1.00	1.45
October	54	61	1.00	1.13
November	61	88	1.00	1.44
Total	148	197	1.00	1.33

The sex ratio of male and female Grey Reef sharks obtained from Makassar Strait tends to approach a balanced condition of 1.00: 1.33. This is proven that the number of male and female do not have a significant difference in terms of the total number of fish. The comparison of sex ratio using the Chi-square test suggests a balanced result (not significantly different) at 95% confidence interval [X^2 count (0.99) < table (db = 2-1) (7.82)]. Based on the number of catches, the female shark is caught more than the male shark. According to Muslih et. al., (2016) states that if a population has more female composition or is equal to the number of males, then the population is still in the ideal category [16]. In addition, a sex ratio of the grey reef shark is 1: 1 [6], and this finding does not look much different from the catch [5], where the sex ratio of male and female grey reef sharks is 1.00: 1.91. The sex ratio in the wild is not absolute but is influenced by the distribution patterns caused by food availability, population density, and food chain balance [15]. Sex ratio is one of the important parameters to be studied to understand the reproductive biology of fish [17].

5. Conclusions

1. The growth pattern of the Grey Reef Shark is negative allometric.
2. The relative condition factor of Grey Reef Shark is in good condition and stable.
3. The sex ratio of males and females of the Grey Reef Shark is close to the balance condition.

References

- [1] Aditya Z F and Al-Fatih S 2017 Perlindungan hukum terhadap ikan hiu dan ikan pari untuk menjaga keseimbangan ekosistem laut Indonesia *Leg. J. Ilm. Huk.* **24** 224–35
- [2] Hardiningsih W, Purwadi H and Latifah E 2017 Dampak Ketiadaan Pengaturan Kuota Ekspor Hiu Tikus (*Alopias Ssp.*) di Indonesia *Padjadjaran J. Law* **4** 588–605
- [3] Efendi H P, Dhewi R T and Ricky R 2019 Keragaman Jenis Dan Distribusi Panjang Ikan Hiu Di Perairan Selat Makassar *Pros. Pus. Ris. Perikan.* **1** 33–42
- [4] Froese R 2006 Cube law, condition factor, and weight-length relationships: history, meta-analysis, and recommendations *J. Appl. Ichthyol.* **22** 241–253
- [5] Zar J H 2010 *Biostatistical Analysis* (New Jersey: Pearson Prentice Hall)
- [6] Nurcahyo H, Sangadji I M and Yudianto P 2016 Komposisi spesies, distribusi Panjang dan radio kelamin hiu yang didaratkan di Jawa Timur, Bali, NTB Dan NTT *Dharmadi Fahmi (Eds). Pros. Simp. Hiu dan Pari di Indones. Kementeri. Kelaut. Dan Perikanan. Jakarta* 33–41
- [7] Bradley D, Conklin E, Papastamatiou Y P, McCauley D J, Pollock K, Kendall B E, Gaines S D, and Caselle J E 2017 Growth and life history variability of the grey reef shark (*Carcharhinus amblyrhynchos*) across its range *PLoS One* **12** e0172370
- [8] White W T, Last P R, Stevens J D, Yearsley G K, and Fahmi D 2006 Economically important sharks and rays of Indonesia. [Hiu dan pari yang bernilai ekonomis penting di Indonesia] *Canberra, Aust. Aust. Cent. Int. Agric. Res.* 208
- [9] Lowry D, de Castro A L F, Mara K, Whitenack LB, Delius B, Burgess G H and Motta P 2009 Determining shark size from forensic analysis of bite damage *Mar. Biol.* **156** 2483–92
- [10] Jublier N and Clua E E 2018 Size assessment of the Gray Reef Shark *Carcharhinus amblyrhynchos* inferred from teeth marks on human wounds *J. Forensic Sci.* **63** 1561–7
- [11] Suruwaky A M and Gunaisah E 2013 Identifikasi Tingkat Eksploitasi Sumber Daya Ikan Kembung Lelaki (*Rastrelliger kanagurta*) Ditinjau dari Hubungan Panjang Berat [The Identification of exploitation level of Male Mackerel (*Rastrelliger kanagurta*) Resources Based on Length-Weight Relationshi *J. Akuatika* **IV** 131–40
- [12] Isa M M, Basri M N A, Zawawi M M, Yahya K and Nor S-A M 2012 Length-weight relationships of some important estuarine fish species from Merbok Estuary, Kedah *J. Nat. Sci. Res.* **2** 8–19

- [13] Sentosa A A, Fahmi F and Chodriyah U 2018 Pola Pertumbuhan dan Faktor Kondisi Hiu Merak Bulu *Carcharhinus brevipinna* di Perairan Selatan Nusa Tenggara *OLDI (Oseanologi dan Limnol. di Indones. 3* 209–18
- [14] Jutan Y, Retraubun A S W, Khouw A S and Nikijuluw V P H 2018 Kondisi ikan hiu berjalan Halmahera (*Hemiscyllium halmahera*) di Perairan Teluk Kao, Halmahera Utara Provinsi Maluku Utara *Prosiding Seminar Nasional Kemaritiman dan Sumber Daya Pulau-Pulau Kecil* vol 2 pp 194–205
- [15] Effendie I M 2002 *Biologi Perikanan [Fisheries Biology]* (Bogor: Yayasan Pustaka Nusantara)
- [16] Muslih, Mahdiana A, Syakti A D, Hidayati N V., Riyanti and Yuneni R R 2016 Beberapa Parameter Populasi Ikan Hiu Martil (*Sphyrna lewini*) di Perairan Laut Jawa dan Kalimantan [Several parameters of the population of hammerhead shark (*Sphyrna lewini*) in the waters of the Java and Borneo] *Prosiding Simposium Hiu Dan Pari Di Indonesia*
- [17] Al-Jufaili S M 2013 Sex Ratio Variation of the Omani Indian Oil Sardine *Sardinella longiceps* (Valenciennes, 1847) *Int. J. Mar. Sci. 3* 402–7

ORIGINALITY REPORT

22%

SIMILARITY INDEX

15%

INTERNET SOURCES

18%

PUBLICATIONS

11%

STUDENT PAPERS

PRIMARY SOURCES

- 1 A Tuwo, I H P Tika, B Yunus, Suwarni, I Yasir, A Yanti, P Y Rahmani, R Aprianto, J Tresnati. " Sex ratio and maturity of orange-dotted tuskfish Bloch, 1791 in Wallace Line at Spermonde Archipelago ", IOP Conference Series: Earth and Environmental Science, 2020
Publication 3%
- 2 A Tuwo, P Y Rahmani, W Samad, M Lanuru, A A Husain, I Yasir, A Yanti, R Aprianto, J Tresnati. " Interannual sex ratio and maturity of Indian parrotfish Bleeker, 1847 in Wallace line at Spermonde Archipelago ", IOP Conference Series: Earth and Environmental Science, 2020
Publication 2%
- 3 publikationen.bibliothek.kit.edu
Internet Source 2%
- 4 www.sciencegate.app
Internet Source 2%
- 5 lib.unnes.ac.id
Internet Source 1%

6

G Wahyudewantoro, Haryono, Sulistiono, R Dina. "Growth pattern, condition factor and reproductive aspects of three spot gourami *Trichopodus trichopterus* (Pallas, 1770) in mangrove waters of Muara Angke Jakarta and Ciperet Cilacap, Indonesia", IOP Conference Series: Earth and Environmental Science, 2021
Publication

1 %

7

Submitted to Sriwijaya University
Student Paper

1 %

8

A. A. Rojas-Herrera. "Length-weight relationships and seasonality in reproduction of six commercially utilized fish species in the coastal lagoon of Tres Palos (Mexico)", *Journal of Applied Ichthyology*, 04/2009
Publication

1 %

9

A Asni, Hamsiah, Rustam, Ilmiah. " Biological Aspects of Shortfin Scad () in Makassar Waters, South Sulawesi, Indonesia ", IOP Conference Series: Earth and Environmental Science, 2019
Publication

1 %

10

Yaris Hikmawansyah, Yuli Andriani, Alexander Muhammad Akbar Khan, Lantun Paradhita Dewanti. "Stock Estimates of White Pomfret (*Pampus argenteus*) Based on Length and Weight Data in Pangandaran Waters", Asian

1 %

Journal of Fisheries and Aquatic Research, 2019

Publication

11

J Tresnati, A L Yanti, D Yanuarita, B S Parawansa, I Yasir, A Yanti, P Y Rahmani, R Aprianto, A Tuwo. " Sex ratio and first maturity of blackeye thicklip wrasse Bloch, 1791 in Spermonde Archipelago ", IOP Conference Series: Earth and Environmental Science, 2020

Publication

1 %

12

repository.ung.ac.id

Internet Source

1 %

13

D. Palacios-Hernández, J.L. Castillo-Géniz, I. Méndez-Loeza, J.C. Pérez-Jiménez. " Temporal and latitudinal comparisons of reproductive parameters in a heavily exploited shark, the bonnethead, (L. 1758), in the southern Gulf of Mexico ", Journal of Fish Biology, 2020

Publication

1 %

14

ejournal.unmus.ac.id

Internet Source

1 %

15

A. Ismen. "Length-weight relationships for ten shark species from Saros Bay (North Aegean Sea)", Journal of Applied Ichthyology, 08/2009

Publication

<1 %

16 Rury Nur Aini, Namastra Probosunu, Eko Setyobudi. " Length-Weight Relationship, Condition Factor and Otolith shape of Marble Goby (at Sermo Reservoir, Yogyakarta ", E3S Web of Conferences, 2020
Publication

17 digilib.uinsby.ac.id
Internet Source

18 I Dewiyanti, S Aminah, A Helmahera, N Nurfadillah, C N Defira. "Growth patterns and condition factor of fish live in Kuala Gigieng waters of Aceh Besar as the basic for sustainable fisheries development", IOP Conference Series: Earth and Environmental Science, 2020
Publication

19 U Chodriyah, R Faizah. "Population parameter, size distribution and sex ratio of the blue shark (*Prionace glauca* Linnaeus, 1758) caught in the southern of Nusa Tenggara", IOP Conference Series: Earth and Environmental Science, 2021
Publication

20 ejournal.stipwunaraha.ac.id
Internet Source

21 www.bioflux.com.ro
Internet Source

Exclude quotes On

Exclude matches < 5 words

Exclude bibliography On